GAP

Gap Analysis Program

User's Manual
Versions 1.0 & 2.0

CGER

Center for Geotechnical and Environmental Research

GAP

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Gap Analysis Program (GAP)
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The Gap Analysis Program (GAP) software and user's manual were developed as part of the research project "Traffic Noise Barrier Overlap Gap Design" sponsored by the Ohio Department of Transportation (State Job No. 14665(0)). The research was conducted at Ohio University through the Ohio Research Institute for Transportation and the Environment. Craig Clum, Research Assistant for the project, wrote the Gap Analysis Program under the direction of Lloyd Herman, Principal Investigator for the project

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Chapter 1

Introduction

GAP Overview

The Gap Analysis Program (GAP) is a Windows 95 computer application created to aid in the analysis and design of overlap gaps in highway noise barriers. The program is intended to be a tool for transportation engineers and planners who are responsible for the design of highway noise barriers.

The program accepts the input of noise barrier, roadway, and receiver geometry and related traffic parameters. Acoustical algorithms process the input data and provide the user with A-weighted, equivalent continuous noise levels at up to 10 receiver locations. A maximum of 10 roadways can be modeled in a single overlap gap analysis.

The results provided by the program are to be used to assist in the design of noise barrier overlap gaps to reduce insertion loss degradation at a overlap gap site. A design can be improved by changing either the geometry of the overlap gap or by installing absorptive panels in the overlap gap region. GAP allows the user to model several different options to arrive at an alternative which is satisfactory.

The overlap barrier noise levels calculated by GAP are not intended to be used for evaluations such as environmental impact statements (EIS) or environmental assessments (EA) which require absolute noise levels at a particular receiver. Rather, the overlap barrier noise levels should be compared to levels predicted at a receiver protected by a single noise barrier. The program contains separate analysis modules that predict the noise levels at a receiver protected by a single barrier and overlapped barriers. By minimizing the difference between the two levels, the insertion loss degradation is minimized and the most effective overlap gap noise barrier design can be attained.

This manual contains the instructions required to successfully model an existing or proposed noise barrier overlap gap using the Gap Analysis Program. Technical discussions on the development of the program have

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not been included. For more information concerning the technical development of GAP, the reader should contact the Ohio Department of Transportation to obtain a copy of the technical manual.

Capabilities of GAP

The following is a list of the capabilities of the Gap Analysis Program.

- Model up to 10 independent receivers located within an overlap gap region.
- Analyze receivers located between both noise barriers.
- Model a maximum of 10 roadways, with each roadway consisting of a single lane.
- Specify the traffic parameters for each roadway.
- Change the overlap width and length of an overlap gap for a particular design.
- Define different top and bottom elevations for each noise barrier.
- Examine the effect of absorptive panels in reducing overlap barrier sound levels.
- Define the horizontal placement of absorptive treatment on each noise barrier.
- Define up to three independent absorptive zones on each noise barrier.
- Predict the A-weighted, equivalent continuous noise levels at receivers protected by a single noise barrier.
- Predict the A-weighted, equivalent continuous noise levels at receivers protected by overlapped noise barriers.
- Inspect the plan and cross section views of modeled noise barrier sites.
- Print various reports detailing the site geometry, parameters, and analysis results.

Chapter 2

Getting Started

This chapter shows you how to:
- Check your system for minimum requirements
- Install the GAP software
- Remove the GAP software
- Start the GAP program

Before Installing GAP

The following software and hardware requirements should be checked before installing the Gap Analysis Program. For best results, the recommended installation is strongly suggested due to long computational times necessary for analyses on slower machines.

Required for Installation

- IBM-compatible 486 computer
- Microsoft Windows 95 or Windows NT
- 8 MB RAM
- 5 MB of free space on the hard disk
- Monitor and graphics card set up in VGA or better
- Microsoft compatible mouse
- 3.5" high-density disk drive

Recommended Installation

- 16 MB RAM
- Pentium processor

Installing GAP

To install the Gap Analysis Program:
1. Insert Disk 1 into the 3.5" drive.
2. Choose **Settings** from the Start menu. Double-click the **Add/Remove Programs** icon from the Control Panel. In the Install/Uninstall tab, click the **Install** button.

or

Select **Run** from the Start menu and type **a:install**.

3. Follow the instructions on-screen to complete the installation.

Removing GAP

To remove the Gap Analysis Program from your hard drive:

1. Choose **Settings** from the Start menu.
2. Double-click the **Add/Remove Programs** icon from the Control Panel.
3. In the Install/Uninstall tab, select **GAP**, click the **Add/Remove** button, and follow the instructions on-screen.

Starting GAP

1. Choose **Programs** from the Start menu.
2. Click the **GAP** program icon.

Chapter 3

File Management

This chapter covers the basics of managing the files used by the Gap Analysis Program. The following topics will be covered:
- Creating new files
- Saving current files
- Opening exiting files
- Quitting the program

Creating a New Overlap Gap Analysis

After starting the program, a new project can be entered. If a new analysis is needed after having an existing file loaded, follow these steps:
1. Click the **File** menu.
2. Select **New Project** from the File menu.

Saving an Overlap Gap Analysis

In order to save a project for later use, perform the following:
1. Click the **File** menu.
2. Select **Save Project** from the File menu.
3. If the project has not been previously saved, input a path and filename in the **Save As** dialog box.
4. Click the **Save** button.

If many analyses are performed on the same overlap gap site in which only a few parameters are being modified, the following technique is suggested for efficient file management.
1. Enter all common data in the required dialog boxes, as detailed in Chapter 4, "**GAP Inputs**."
2. Click the **File** menu.
3. Select **Save Project As** from the File menu.
4. Input a path and filename in the **Save As** dialog box.
5. Click the **Save** button.
This process can be performed as many times as needed and will eliminate the repetitive task of entering identical data.

Opening an Existing Overlap Gap Analysis

To open an existing file:
1. Click the **File** menu.
2. Select **Open Project** from the File menu.
3. Specify the path and the filename for the file you wish to open in the **Open** dialog box.
4. Click the **Open** button.

Quitting GAP

To close a project:
1. Click the **File** menu.
2. Select **Close Project** from the File menu.

To close a project and exit the Gap Analysis Program:
1. Click the **File** menu.
2. Select **Exit** from the File Menu.

Chapter 4

GAP Inputs

The user must provide the program with information required to perform an analysis. This chapter will cover these necessary inputs and other topics as highlighted in the list below:

- Limitations of the program
- Noise barrier inputs
- Roadway inputs
- Receiver inputs

This manual is organized in the order in which the user-inputs must be entered. When first setting up an analysis file, **the inputs must be entered in this order** before other menu items can be accessed.

Assumptions and Limitations of the Program

Due to the complex nature of the problem, several assumptions and limitations had to be made in the development of GAP. It is important to be familiar with these assumptions and limitations to avoid modeling errors in either the input, output or both.

- Reflections are assumed to be specular (sound energy does not scatter upon striking a surface.
- Noise flanking the ends of a barrier (edge diffraction or side flanking) does not significantly affect the sound levels at receivers located at an overlap gap site.
- Double diffraction does not result in an appreciable attenuation of sound levels.
- Ground reflections are insignificant and may be ignored.
- All receivers must be lower than both barriers (every receiver is located in the shadow zone).
- Assume the ground at all sites is acoustically hard ($\alpha=0$).
- All barriers and roadways must be parallel to the X-axis.
- Assume all barriers are freestanding walls, not earthen berms.
- Traffic speeds must be in the range of 45 to 110 km/h.
- All input coordinates must be positive.

It should be noted that all units input into the Gap Analysis Program must be **metric**. For barriers, roadways, and receivers, coordinate values must be input in meters. Traffic speeds should be entered in kilometers per hour (km/h).

Noise Barrier Inputs

For each analysis, a single barrier and the overlapped barriers must be specified. The parameters covered in the following sections can be accessed through the Barrier menu option.

Single Barrier Geometry

The data that must be input first in an overlap analysis is the geometry of a single noise barrier that would exist in place of an overlap gap.

- X and Y-coordinates of both ends of the barrier
- Top and bottom elevations of the barrier

A simplifying restriction of the program is that all barriers and roadways are parallel to each other and to the X-axis. Therefore, the Y-coordinates should be the same for both ends of the single barrier. The program will not prevent the user from inputting coordinates which do not meet these guidelines. However, errors may occur if the data is not input using the aforementioned method. Furthermore, the X-coordinate of point 2 must be greater than the X-coordinate of point 1. This is true for all barriers and roadways. It should be noted that the elevation of the single barrier remains constant. A site that is situated on a grade cannot be modeled as such. An average elevation for the barrier must be determined for these inputs.

Overlap Barrier Geometry

The specification of the overlap barrier geometry is related directly to the data entered into the single barrier geometry input window. The following items are the necessary inputs for the overlap barrier geometry.

- Single barrier breakpoint
- Overlap gap width and length
- Overlap gap orientation
- Top and bottom elevations of the near barrier

The first item to be input is the single barrier breakpoint. The breakpoint is defined as the X-coordinate of the far barrier where the overlap gap originates. The breakpoint must be located towards the middle of the single noise barrier defined in the previous step. The program will only accept breakpoint values which are located within 10% of the single barrier length from the midpoint. This is a conservative estimate necessary to guarantee that the overlap is situated near the middle of the specified barrier site. If the overlap were located close to one end, noise contributions at a receiver due to side flanking at the end of the barrier could result and would not be accounted for by the program.

The overlap length and width are straightforward. The distance that the near and far barriers extend past one another is known as the overlap length. The overlap width is the perpendicular distance between the two barriers.

Roadway
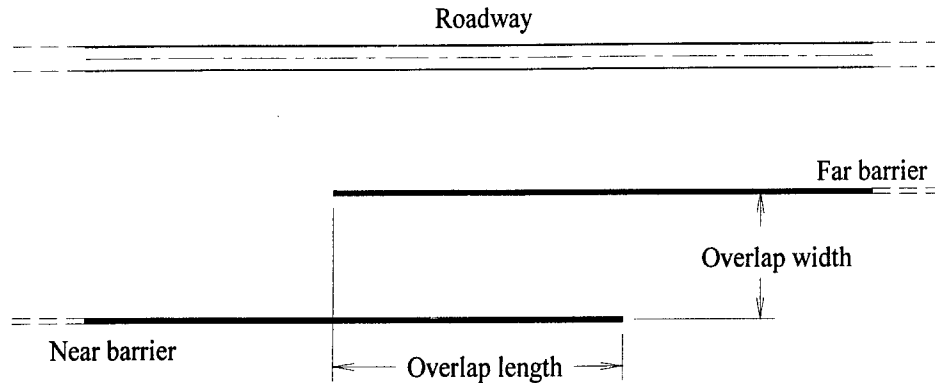
The single barrier is related closely to the overlapped barriers through the breakpoint, overlap length, and overlap width. The far barrier is located at the same Y-coordinate as the single barrier. The far barrier is specified as such because all receivers must be positioned on the residential side of the single barrier. By defining the far wall along this same horizontal alignment, all receivers are assured of being on the residential side of the far barrier as well. One endpoint of the far barrier is situated at the breakpoint. The other endpoint is determined based on the overlap gap orientation.

The overlap gap orientation defines whether the near barrier extends to the left or right of the overlap gap area. If the longest dimension of the near barrier extends to the left of the overlap gap area, the overlap gap is left-oriented. Conversely, if the longest dimension of the near barrier extends to the right of the overlap gap area, the overlap gap is right-oriented. It is important to note that the overlap gap orientation should not be changed after inputting subsequent data as erroneous calculations may result. A new analysis file should be created to test data which involves a different gap orientation.

Roadway

a) Left overlap gap orientation

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Roadway
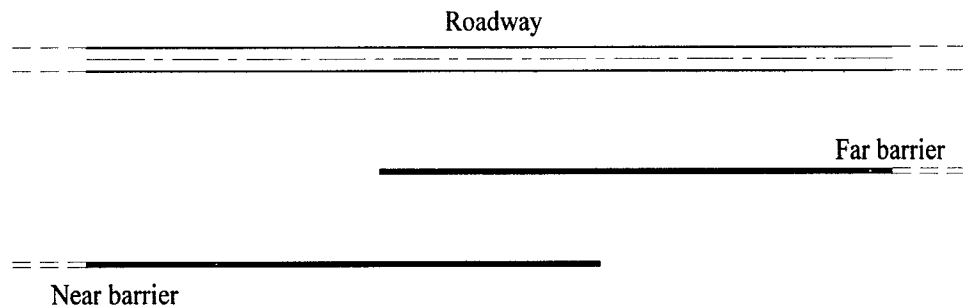
Far barrier
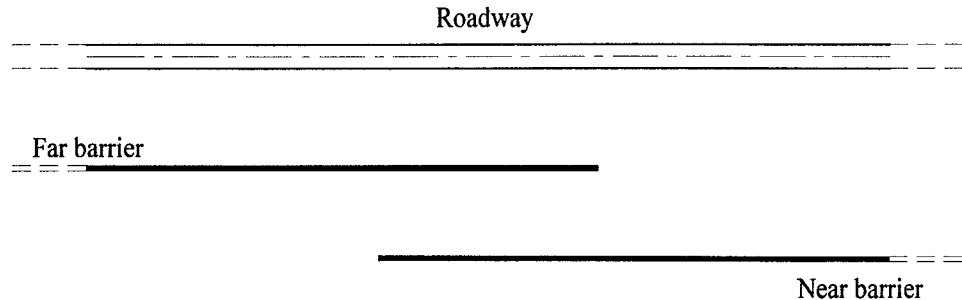
Near barrier

b) Right overlap gap orientation

The near barrier is positioned relative to the placement of the far barrier. The far barrier is always located closest to the highway. The near barrier is offset back from the far barrier a distance equal to the overlap width. The near barrier is always parallel to the highway and far barrier and is also oriented parallel to the X-axis. The near barrier is assigned an endpoint that extends the overlap end of the near barrier a distance equal to the overlap length past the breakpoint of the far barrier. The overlapped barriers combined are the same length as the single barrier when considering the length of the walls from the non-overlap end of the far barrier to the non-overlap end of the near barrier. The near and far walls are each assigned one of the single barrier's endpoints, depending on the gap orientation. The other endpoints are assigned based on the breakpoint and overlap length.

The far wall maintains the same elevations as given to the single barrier. However, the top and bottom elevations of the near barrier can be assigned independently from the far barrier. This is useful since overlapped barriers are on different horizontal alignments and are rarely found at the same elevations.

It is recommended that the coordinate system for a noise barrier overlap gap analysis be established so that all coordinates of every input be a relatively large positive number. GAP will not accept negative coordinates as input. Depending on the overlap gap orientation, a transformation of coordinates may be performed by the program when analyzing the overlap site. This transformation process may convert some coordinates into negative numbers which may or may not result in analysis errors. By

entering coordinates that are significantly greater than zero, these errors can be avoided.

Absorptive Barriers

The primary problem with overlap gaps is the propagation of sound waves through the gap by reflective mechanisms. Absorptive panels are an effective method of attenuating these sound waves. The GAP model allows the user to specify the location of absorptive panels both vertically and horizontally on each noise barrier.

- Vertical location of up to three different absorptive zones on each barrier
- Horizontal location of the absorptive zone on each barrier

A maximum of three absorptive zones can be specified on a respective noise barrier. By specifying three zones, the barrier can be modeled with absorptive panels located in the middle of the barrier without treating the

top or bottom sections. Each zone is specified by its top and bottom elevations and its NRC value.

Top of barrier

Bottom of barrier
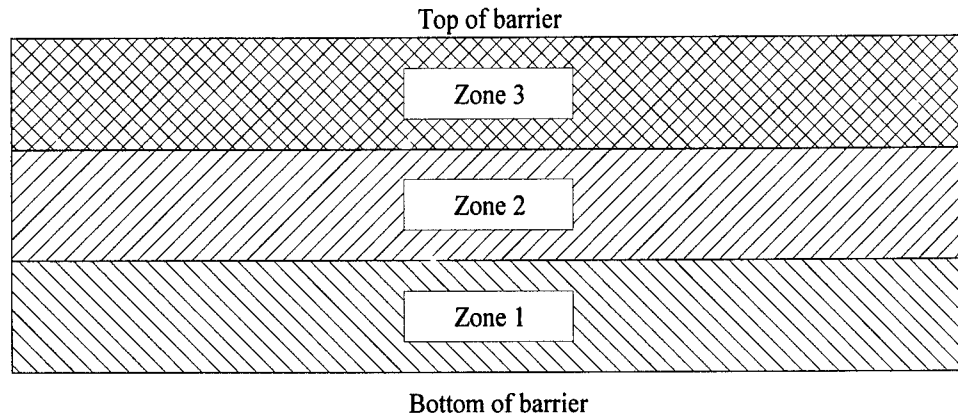
The model is designed so that separate zones and absorptive coefficients can be specified for the near and far barriers. The program defaults to a one-zone barrier with no absorptive treatment (NRC=0.05) if no zones are specified. An NRC of 0.05 is representative of a typical reflective barrier.

In addition to specifying the vertical location of the individual absorptive zones, horizontal limits for the treatment can also be set for each barrier. The default settings are the coordinates defining the endpoints of the overlap for both barriers. However, the limits can be modified for each barrier independently to include less of the overlap length by changing the endpoints of the absorptive zones. Conversely, the zones may also be expanded to include barrier surfaces outside of the overlap gap as well.

The absorptive treatment is specified using the following steps.
1. On the Barrier menu, select the **Absorptive Barriers** item.
2. Choose either the **Near Barrier** or **Far Barrier** option, depending on which barrier the absorptive treatment is being modeled.
3. In the dialog box shown previously, select the **Total Number of Absorption Zones** to be modeled for the barrier (a maximum of three zones may be modeled).
4. Input the vertical elevations for each absorptive zone in the Absorption Zone Elevations & Coefficients frame.
5. Input the horizontal limits (X-coordinates) of the absorptive treatment on the barrier in the Endpoints of Absorptive Zones frame.
6. For each respective absorptive zone, click the **Zone** button within the NRC frame. Input the noise reduction coefficient in the Absorption Coefficients dialog box. Click the **OK** button.
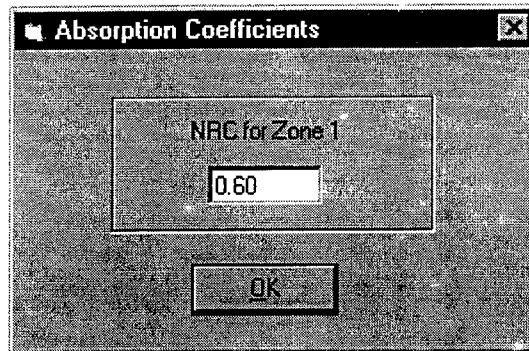
Absorption Coefficients

NRC for Zone 1

0.60

OK

7. When the noise reduction coefficients have been entered for each zone, click the **OK** button on the Absorptive Barriers dialog box.

Roadway Inputs

After establishing the barrier geometry, the roadways must be defined. The roadway inputs consist of both the roadway geometry and the traffic existing on the roadways during an analysis period. The parameters covered in the following sections can be accessed through the Roadway menu option.

Roadway Geometry

The roadway geometry is input in a manner similar to the single barrier geometry. The inputs required in the roadway geometry dialog box are listed below.

- Total number of roadways being modeled
- X and Y-coordinates of both ends of each roadway
- Elevation of each roadway

The X and Y-coordinates of the centerline for each roadway are specified as well as the roadway elevation. Each roadway must be parallel to the noise barriers and the X-axis. Therefore, the Y-coordinates should be the same for each roadway to ensure these conditions are satisfied. Theoretically, the roadway can be of any length. However, it is good practice to assign X-coordinates for each roadway that are close to the endpoints of the single barrier. The X-coordinate of point 2 must be greater than the X-coordinate of point 1. Each roadway must extend past all receivers in both directions.

As with the barrier elevations, roadway elevations are constant along the length of the road. The Y-coordinates of each roadway must be greater than the Y-coordinates of the noise barriers.

A maximum of 10 roadways can be modeled in an overlap gap analysis. The program was designed to model each lane of traffic as separate roadways. This is necessary since precise distances and angular measurements are calculated in the iterative process of analyzing reflections. In other traffic noise prediction models, it is common practice to model several lanes of traffic as one roadway. However, most of these models do not calculate the sound contributions from multiple reflections.

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It is recommended that each lane of traffic be modeled separately and not as one "equivalent" roadway for best results.

The roadway geometry is defined as follows.
1. On the Roadway menu, select the **Geometry** item.
2. Select the **Total Number of Roadways to be Modeled** for the barrier (a maximum of 10 roadways may be modeled).
3. Input the X and Y-coordinates of each roadway in the Roadway Data frame.
4. In the Roadway Data frame, input the elevation of each roadway.
5. If multiple roadways are being modeled, click either the **Previous** or **Next** button to enter data for the additional roadways.
6. Click the **OK** button when all roadway data has been entered.

Traffic Parameters

For each roadway that is modeled, traffic data is needed to characterize the source. The traffic parameters required are the traffic volumes and speeds. These parameters are needed for each roadway subdivided further based on the classifications of automobiles, medium trucks, and heavy trucks.

The traffic volumes input should represent the volumes for a one-hour time period. The speeds must be input in kilometers per hour (km/h). Limitations require that speeds be in the range from 45 to 110 km/h. The program will not accept values outside of this range. Not all volumes for a

roadway can be set to zero. Individual classes can have zero volumes but all modeled roadways must have at least one class input.

To input the traffic data, the following steps should be used.
1. On the Roadway menu, select the **Traffic** item.
2. Input the traffic volumes and speeds based on vehicle classification for each roadway.
3. If multiple roadways are being modeled, click either the **Previous** or **Next** button to enter traffic data for the additional roadways.
4. Click the **OK** button when all traffic data has been entered.

Reference Energy Mean Emissions Levels

The reference energy mean emission levels (REMELs) are calculated for each vehicle class on each roadway. To view the REMELs calculated based on the traffic data input, click the **Reference Levels** option on the Roadway menu. The REMELs for each roadway can be inspected by clicking the vertical scroll button.
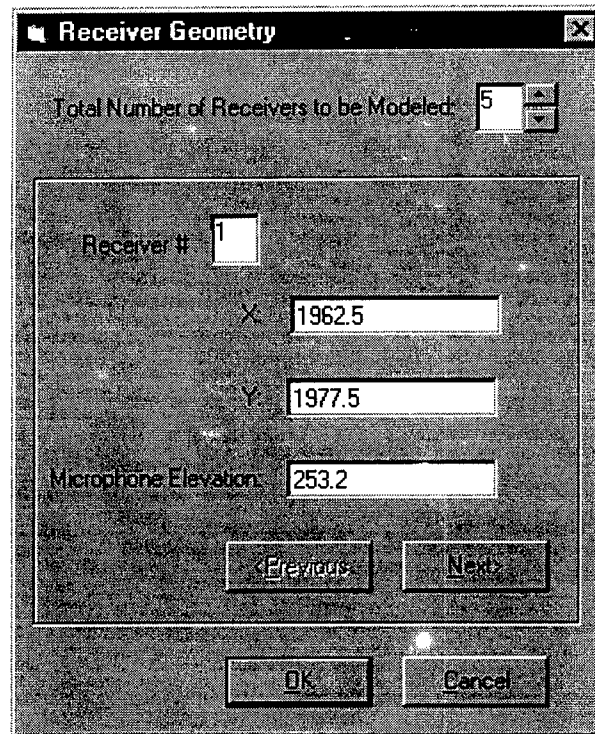

Receiver Inputs

A maximum of 10 receivers can be modeled in an overlap gap analysis. The required user-inputs are listed below.

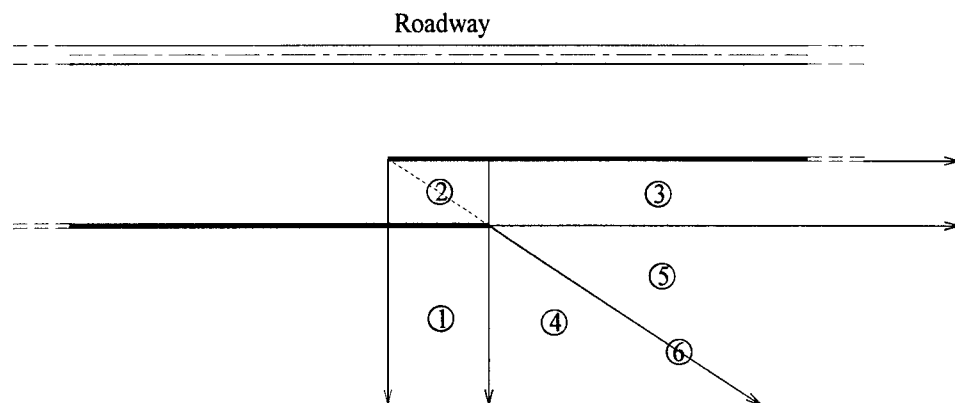■ Total number of receivers being modeled

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- X and Y-coordinates of each receiver
- Elevation of each receiver

A receiver must be located in one of the six regions defined in the following figure. Receivers not located in these regions can be analyzed by standard noise prediction programs. GAP will not permit the input of receivers outside of these regions.

Note: Case 6 is located on the line drawn between the ends of the far and near barriers.

There are limitations to the placement of receivers in these regions. Although the program will accept any input of receivers within the specified regions, prediction accuracy decreases as the distance between the overlap gap and a receiver increases. A practical limit is to locate all receivers within a 100 meter radius of the overlap gap. The elevation of each receiver must be lower than the top of both noise barriers.

Receiver data is input by the following method.
1. On the Receiver menu, select the **Geometry** item.
2. Input the X and Y-coordinates for each receiver.
3. Input the microphone elevation for each receiver.
4. If multiple receivers are being modeled, click either the **Previous** or **Next** button to enter data for the additional receivers.
5. Click the **OK** button when all receiver data has been entered.

Chapter 5

GAP Outputs

The previous chapter covered the steps necessary to prepare the input data for analysis. This chapter will cover the following analyses and outputs :

- Single barrier analysis
- Overlap barrier analysis
- Graphical output of data
- Output of data to a printer

Sound Level Analyses

The sound level analyses carry out all needed calculations using the input data to compute the sound levels at each receiver. The following sections detail the two analyses which GAP performs.

Single Barrier Analysis

A single barrier analysis is conducted by the following steps.
1. On the Sound Level Analysis menu, select the **Single Barrier** item.
2. The sound levels are displayed when the analysis is complete.
3. If multiple receivers have been modeled, click the vertical scroll button to examine the additional receivers' sound levels.
4. Click the **OK** button to close the Single Barrier Analysis window.
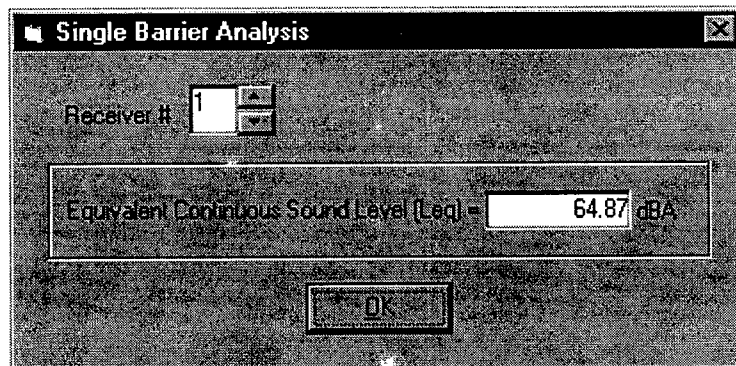
The results from the single barrier analysis can be reviewed in the single barrier analysis output window. This window displays the equivalent

continuous sound level for each receiver as if protected by a single noise barrier with no overlap gap.

Overlap Barrier Analysis

Follow these directions to conduct an overlap barrier analysis.
1. On the Sound Level Analysis menu, select the **Overlap Barriers** item.
2. The sound levels are displayed when the analysis is complete.
3. If multiple receivers have been modeled, click the vertical scroll button to examine the additional receivers' sound levels.
4. Click the **OK** button to close the Overlap Gap Analysis window.


The primary objective of this model is to determine the equivalent continuous sound levels at receivers which are influenced by an overlap gap. The difference in sound levels between the single barrier and overlap barrier analyses provides the user with an approximation of the insertion loss degradation due to the introduction of the overlap gap in the noise barrier.

In addition to the receiver's sound level, statistics from the overlap gap analysis procedure are also displayed in this window. These statistics provide the user with information regarding a receiver's susceptibility to reflective rays. Included in the statistics is the overlap region in which the receiver is located, denoted by the receiver case. The total number of multiple reflected diffracted rays (MRDR) analyzed and a count of the MRDR that actually contribute to a receiver's sound level are shown. Equivalent data is displayed for multiple reflected rays (MRR). These statistics are summed to give a total count of reflected rays that are analyzed and a count of the reflected rays which contribute to each receiver's sound level.

Graphical Output of Noise Barrier Site

In order to verify the site was modeled correctly, two graphic views can be inspected on-screen. The plan view of the entire site and the cross section view at each receiver can be accessed through the GAP program after all necessary inputs have been provided. To examine the plan view of the noise barrier site, click the **Graphical Views of Site** on the Sound Level Analysis menu.

The plan view shows the noise barriers, receivers, centerline location of the roadways, and also indicates the portions of the barriers, if any, that are modeled with absorptive treatment. It should be noted that the plan view is scaled to show only the region including the overlap gap and the receivers. Roadways and barriers may extend beyond what is shown in the plan view.
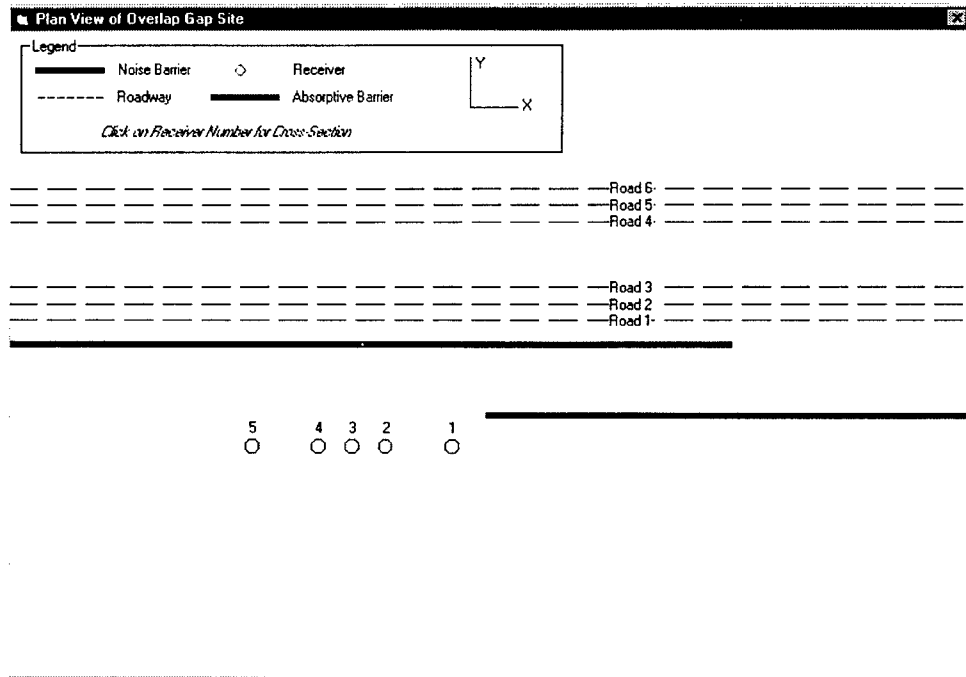
The cross section view for each receiver can be accessed by clicking a receiver number on the plan view. This view shows the noise barriers, the centerline of the roadways, and the receiver selected on the plan view. If absorptive treatment has been modeled, the cross section view will delineate between the different vertical absorptive zones.

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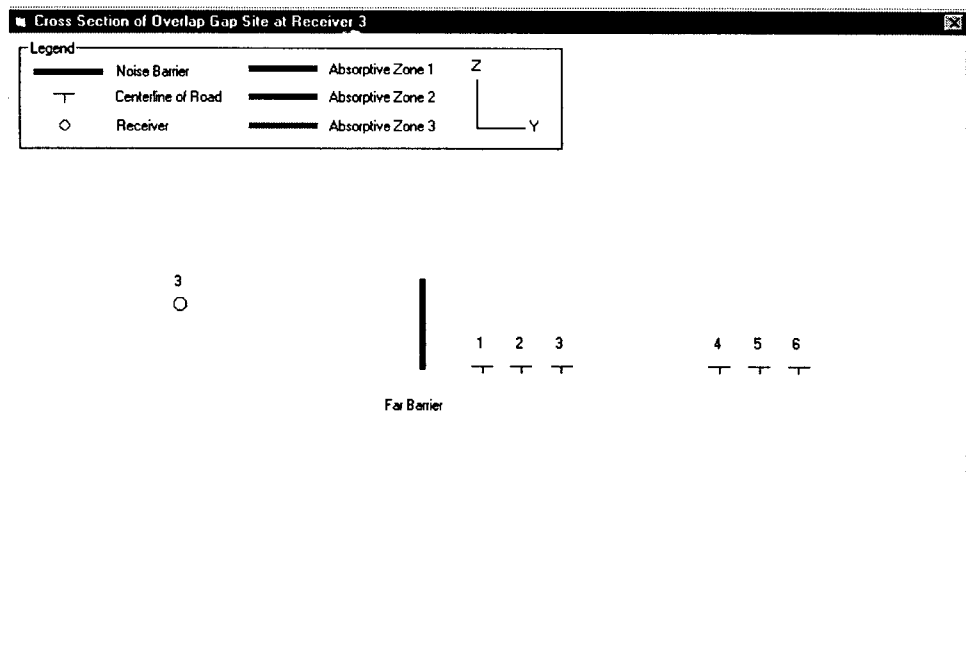
Output of Results to a Printer

The input data and the analysis results can be output to a printer enabling the user to maintain a record of each trial. Different output options can be selected as shown in the following window.
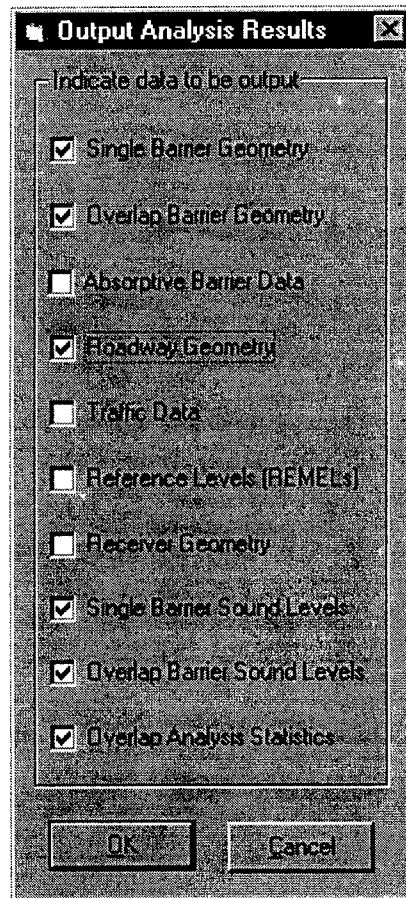
To output the input data and analysis results to a printer, perform the following.

1. On the File menu, select the **Print** item.
2. Select the data options to be output.
3. Click the **OK** button to close the Output Analysis Results window.
4. Click the **OK** button on the **Print** dialog window.

Chapter 6

GAP Version 2.0

In order to analyze absorptive panels which are modeled for image ray reflection attenuation, the frequency of the sound waves must be taken into account. GAP Version 1.0 utilizes the noise reduction coefficient (NRC) for sound absorption calculation. However, the NRC is only composed from four frequencies: 250, 500, 1000, and 2000 Hz. The NRC is the average absorption coefficient for these four frequencies. The frequency range that is audible to the human ear is approximately 20 - 20,000 Hz. Most highway traffic noise consists of sound wave frequencies between 50 - 10,000 Hz.

In the 50 - 10,000 Hz range, there are eight octaves with center-band frequencies of 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz. The equivalent continuous sound level at a receiver consists of noise from all frequencies in this range. However, different materials used for absorptive panels are better for attenuating sound waves of different frequencies. To evaluate the performance of absorptive treatment more effectively, GAP Version 2.0 was created. Version 2.0 allows the user to specify an absorption coefficient for each of the eight octave band center frequencies. This allows greater flexibility in analyzing different absorptive materials.

Version 2.0 varies from Version 1.0 in that different REMEL equations were used to calculate the noise levels produced at the source. This allows the computation of noise levels at each individual octave center-band frequency. All supporting algorithms are upgraded to assure compatibility with these REMEL equations. The calculations are more involved in the second version requiring greater computational time to complete noise analyses.

Absorptive Barriers

The method of specifying absorptive treatment in Version 2.0 is very similar to that of Version 1.0. However, there are some differences that are detailed in the following section.

The absorptive treatment in Version 2.0 is specified as follows.
1. On the Barrier menu, select the **Absorptive Barriers** item.
2. Choose either the **Near Barrier** or **Far Barrier** option, depending on which barrier the absorptive treatment is being modeled.

3. In the absorptive barriers dialog box, select the **Total Number of Absorption Zones** to be modeled for the barrier (a maximum of three zones may be modeled).

4. Input the vertical elevations for each absorptive zone in the Absorption Zone Elevations & Coefficients frame.
5. Input the horizontal limits (X-coordinates) of the absorptive treatment on the barrier in the Endpoints of Absorptive Zones frame.
6. For each respective absorptive zone, click the **Zone** button within the Absorption Coefficients frame. Input the appropriate absorption coefficients for the material being modeled in the Absorption Coefficients dialog box. Click the **OK** button.

Absorption Coefficients

Absorption Coefficients for Zone 1

Frequency

63 Hz	0.05
125 Hz	0.41
250 Hz	0.87
500 Hz	1.00
1000 Hz	1.00
2000 Hz	1.00
4000 Hz	0.88
8000 Hz	.55

OK

7. When the noise reduction coefficients have been entered for each zone, click the **OK** button on the Absorptive Barriers dialog box.

Version 2.0 Overlap Barrier Analysis

The results from a GAP Version 2.0 overlap barrier analysis are more thorough in that the sound level for each octave band center frequency is determined. After performing an overlap gap analysis, the user may view the individual noise levels for each of the eight octave band center frequencies through the overlap gap analysis output window. These noise levels are displayed in the octave levels output window.

Follow these directions to conduct an overlap barrier analysis.
1. On the Sound Level Analysis menu, select the **Overlap Barriers** item.
2. The sound levels are displayed when the analysis is complete.
3. If multiple receivers have been modeled, click the vertical scroll button to examine the additional receivers' overall sound levels.

5. Click the **View Individual Octave Levels** button to investigate the individual octave band noise levels for each receiver.

Octave Levels

Receiver # 1

63 Hz	44.30	dBA
125 Hz	52.02	dBA
250 Hz	56.12	dBA
500 Hz	59.03	dBA
1000 Hz	60.22	dBA
2000 Hz	58.82	dBA
4000 Hz	51.10	dBA
8000 Hz	43.88	dBA

OK

6. If multiple receivers have been modeled, click the vertical scroll button to examine the additional receivers' individual octave sound levels.
7. Click the **OK** button to close the Octave Levels window.
8. Click the **OK** button to close the Overlap Gap Analysis window.

Chapter 7

Overlap Gap Analysis Example

In order to give the user practice in using GAP, an example problem has been given. This exercise will verify that the analysis procedure is being followed correctly. The input data has been provided in the sections which follow. The reader is instructed to follow the instructions given in previous chapters to input this data and to conduct the analyses. The sound levels calculated from the given data are provided at the end of this chapter. If the user's results are different, check the input data to ensure that all variables were entered correctly. The example problem models reflective noise barriers. Consequently, no data is required to be entered for absorptive barriers. This example problem is presented using Version 1.0 of the GAP model.

This illustration shows the plan view of the example problem to be modeled in this chapter.
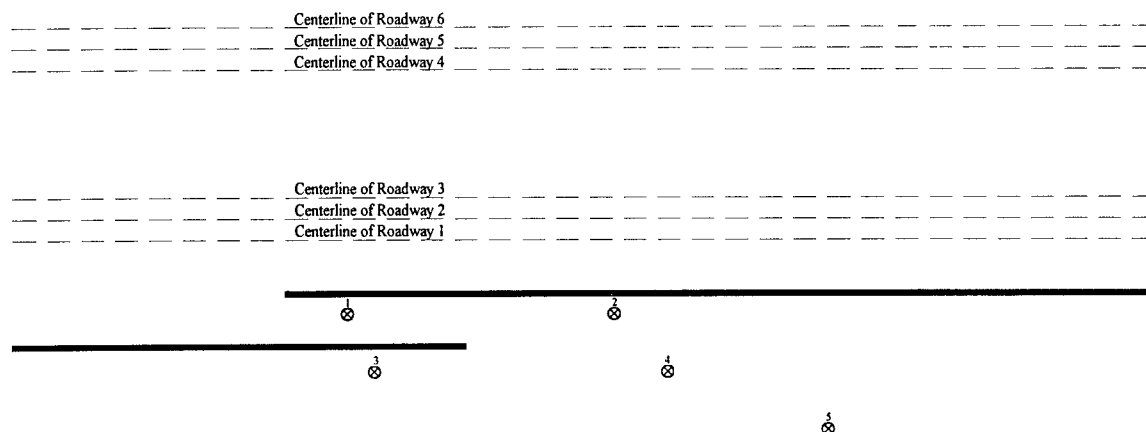
The following sections provide the necessary geometrical data to properly model this overlap gap site.

Single Barrier Geometry

Barrier	X1 (m)	Y1 (m)	X2 (m)	Y2 (m)	Bottom Elevation (m)	Top Elevation (m)
Single	1500	2000	2500	2000	274.9	281.0

Overlap Barrier Geometry

Barrier	X1 (m)	Y1 (m)	X2 (m)	Y2 (m)	Bottom Elevation (m)	Top Elevation (m)
Far	2000	2000	2500	2000	274.9	281.0
Near	1500	1990.9	2030.5	1990.9	274.3	280.7

Single barrier breakpoint: 2000
Overlap width: 9.1
Overlap length: 30.5
Overlap gap orientation: Left

Roadway Geometry

Roadway	X1 (m)	Y1 (m)	X2 (m)	Y2 (m)	Elevation (m)
1	1500	2009.3	2500	2009.3	276.2
2	1500	2013	2500	2013	276.2
3	1500	2016.6	2500	2016.6	276.2
4	1500	2038.8	2500	2038.8	276.1
5	1500	2042.5	2500	2042.5	276.1
6	1500	2046.1	2500	2046.1	276.1

Traffic Parameters

Lane #	Volumes (veh/h)			Speeds (km/h)		
	A	MT	HT	A	MT	HT
1	732	24	96	89.5	87.2	87.2
2	696	48	120	91.9	85	85
3	660	12	0	94.1	86.1	0
4	624	24	36	87.2	89.6	85
5	972	48	240	87.2	87.2	85
6	456	24	132	94.5	91.9	85

Receiver Geometry

Receiver	X (m)	Y (m)	Elevation (m)
1	2010.5	1996.5	278.4
2	2055.5	1996.5	278.6
3	2015.0	1986.5	279.3
4	2064.5	1986.5	277.8
5	2091.5	1976.5	277.6

Single Barrier Analysis Results

Receiver	Single Barrier Sound Level
1	65.0
2	65.4
3	67.7
4	65.4
5	65.1

Overlap Barrier Analysis Results

Receiver	Receiver Case	Overlap Barrier Sound Level
1	2	76.2
2	3	68.8
3	1	66.7
4	5	67.6
5	5	65.6